BELIDEUS GRACILIS — SOARING PROBLEMS FOR AN OLD DE VIS GLIDER

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The taxonomic status of *Belideus gracilis* de Vis 1883 is reviewed in the light of the discovery of 3 large glider skins and their skulls, from Mt Echo, NE Queensland, during the Queensland Museum's 1986 move to new premises. De Vis' poor record in extant mammalian taxonomy is discussed in terms of his rash descriptions of *Dromicia frontalis* and *Pseudocheirus mongan*. Skull and tail morphology of the Mt Echo specimens differ from typical *Petaurus norfolcensis*, but it is concluded that at present *gracilis* should remain a junior synonym of *norfolcensis* and that caution should be exercised in applying the subspecific title *gracilis* to gliders from outside the Mt Echo area.

□ *Petauridae, Possum, Belideus gracilis, Petaurus norfolcensis, Mt Echo.*

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Charles de Vis was a late starter in the field of extant mammal taxonomy. He was 54 when he described his first marsupial type, and at the age of 78, two years after his retirement, he published, albeit 'reluctantly', the description of what was to be his last new mammal, a giant rat from New Guinea: '. . . I hardly feel justified in running the risk of perpetuating a synonym, otherwise I should propose for it the name *Dendrosminthus aroaensis*' (de Vis 1907, p. 11).

Of his 15 extant mammals from Australia and New Guinea, Bennett's tree-kangaroo, *Dendrolagus bennettianus* and a fruit-bat *Dobsonia pannietensis* are still regarded as specifically distinct (Groves, 1982; Bergmans, 1979), while the status of *Dendrosminthus aroaensis* is currently being reassessed (T. Flannery, pers. comm.). All others have slipped into junior synonymy.

The contribution of de Vis to modern mammalogy must be regarded with some suspicion, not only for his equivocal approach to species descriptions (see *D. aroaensis* quote above) but more particularly for his worst mistake, which was a description in 1886 of the Feathertail Glider *Acrobates pygmaeus* — a distinctive and ubiquitous species already described 93 years earlier (Shaw 1793) — as a 'new' pigmy possum, *Dromicia frontalis*. This he based on three well-preserved spirit specimens collected for him by Kendall Broadbent in north Queensland. In his description, de Vis recognized that each of the three was sub-adult, each possessed a 'distinct patagial fold' (p. 1134) and that the hair of the tail had 'a distinct tendency to form a fringe on either side' (p. 1135). Yet he failed to recognise that the specimens represented *Acrobates pygmaeus*.

However, de Vis' first mammalian description, published in 1883 of the gliding possum *Belideus gracilis* and treated merely as synonymous with *Petaurus norfolcensis* as early as 1888 by Thomas, may yet prove to be correct. The significance of this description and its enigmatic connection to three very old museum glider skins is now discussed.

THE *B. GRACILIS* DESCRIPTION AND ITS BACKGROUND

On March 18, 1882, in 'The Naturalist' column of the 'Queenslander' newspaper, de Vis, in his unique and charming style, introduced his readers to Australia's gliding possums:

'Many who with senses impressible by the objects around them, have long been dwellers in the wilderness are acquainted with the prettiest of its aborigines — the flying possum — more suggestively, flying squirrel, more correctly petaurist. With its soft-piled delicately tinted mantle of silky fur, calm demeanor, and admirable temper, the petaurists are the gentles of the race, and would make charming pets but like many gentles of another race, they display their dress and pursue their pleasures only at night'.

This was a fitting tribute to the group of marsupials from which de Vis' first mammalian

type description would come early in 1883, the beginning of his second calendar year as the curator of the Queensland Museum. The new glider, which de Vis chose to name *Belideus gracilis,* had been sent to him by Kendall Broadbent from the Cardwell area of northern Queensland. First mention of it was made in the Minutes of the Board Meeting published in the 'Brisbane Courier' 9 November 1882 p. 5. 'A cursory examination of the specimens shows that two new birds, a new flying squirrel and two or more new fish have been acquired. It is very desirable that Mr Broadbent should be sent into the interior to collect on the Diamantina and Georgina rivers'.

The formal description which was published in April 1883 drew attention to the following features which de Vis considered unique to *gracilis*: its large size ('between *B. australis* and *B. sciureus* [*norfolcensis*] . . . its markings and in having shorter ears and a rather more slender and less hairy tail') (de Vis 1883c, p. 620).

However, in anticipation of this description, its abstract was read to the December 27 (1882) meeting of the Linnean Society of New South Wales and was subsequently published in January 1883 (de Vis 1883a). This January announcement of the new species *Belideus gracilis,* accompanied by those diagnostic features considered significant by de Vis, therefore pre-empted the formal April (1883c) account as the original description of *B. gracilis.*

An identical copy of this original Linnean Society abstract appeared in print a few weeks later (Jan. 1883) in the *Southern Science Record* (de Vis 1883b).

The annual report of the Trustees of the Queensland Museum for the year 1882, tabled in Parliament on 26 June 1883, notes *B. gracilis* in Appendix VII ('List of species of which types have been placed in museum'). However, it is not known if a single type specimen was ever formally nominated and marked as such, or if the holotype was mounted and put on public display in keeping with the museum's habit of displaying every specimen and dispensing with duplicates (see Ingram 1986, p. 161).

As early as 1888, Thomas treated *Belideus gracilis* as synonymous with *Petaurus norfolcensis* (then as *Petaurus sciureus*) and subsequent references to *B. gracilis* deal with it as a northern subspecies of *norfolcensis* (Iredale and Troughton, 1934; Marlow, 1962; Troughton, 1973; Suckling, 1983). None of these authors records having made a personal examination of a *B. gracilis* holotype or topotype.

THE THREE GLIDER SKINS AND MT ECHO

During the Queensland Museum's move to new premises in 1986, three faded study skins representing large gliding possums were found in a drawer containing old gallery mounts. None of the gliders bore registration numbers, though each carried two tags. One was printed on paper stating the date '1886', the initials of the collector 'K.B.' (Kendall Broadbent), the locality "Mt. Echu, Herbert River" (= Mt Echo, Herbert River) and a 'cabinet name' which alluded to the agile nature of the gliders. (Cabinet names were unpublished convenient titles which de Vis used to differentiate forms which he considered distinct). This label was not written in de Vis' own hand. The second tag attached to each skin was a wooden sliver, commonly used by de Vis with spirit specimens, on which de Vis had written in pencil the name '*P. sciureus*' and a letter 'a', 'f' or 'g'. The letters corresponded with de Vis' own hand-written catalogue cards which are still held in the Museum. These cards confirm the collection locality and sex of the three glider skins which are accessed under the specific title of '*sciureus* Shaw', but with a further note in parentheses, mentioning again the cabinet name. The unwieldy and confusing nature of de Vis' cataloguing system is discussed by Ingram (1986, p. 162).

The outstanding size of the three glider skins, their extremely long, thin, sparsely-haired tails and the pattern of fur coloration agree closely with de Vis' description of *B. gracilis* from 'North of Cardwell' (de Vis, 1883c, p. 620). In particular the vital measurements included by de Vis in his formal description are matched in the skins (Figs 1 and 2).

The coincidence of the *gracilis* description matching these skins is too significant to be overlooked, yet the evidence to identify them as possible syntypes is too open-ended to provide a convincing explanation. Three possible explanations are as follows:

(a) The gliders may represent the original specimens sent from Broadbent in 1882 and the species described by de Vis early the next year.
This suggestion considers as most significant the corroboration of the large measurements and fur patterns presented by de Vis in his description with the three large skins. The collection locality as stated by de Vis was 'North of Cardwell'. Mt Echo is 18 km SW of Cardwell, being part of the southwestern slopes of the Cardwell Range overlooking the Herbert River valley, and approached from Ingham. 'North of

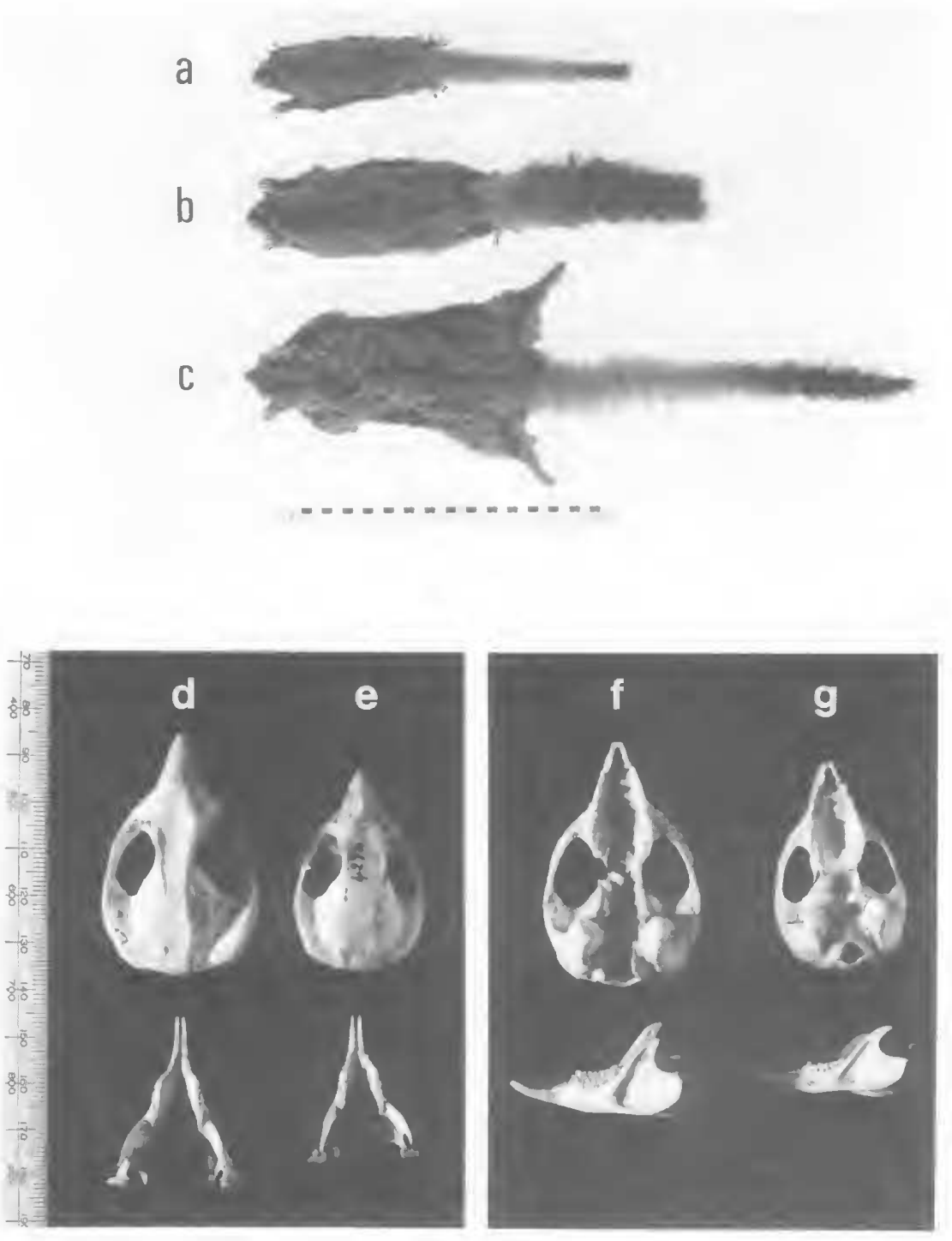

FIG. 1. Comparison of the Mt Echo *Petaurus norfolcensis* (c) JM5521 with average-sized specimens of *P. breviceps* (a) J10466 from Gordonvale NEQ and *P. norfolcensis* (b) J11514 from Warwick SEQ. d and f, skull and dentary of the Mt Echo *P. norfolcensis* JM5523. e and g, skull and dentary of an average-sized *P. norfolcensis* J4270 from Brisbane SEQ. (J and JM registrations represent specimens housed in the Queensland Museum).

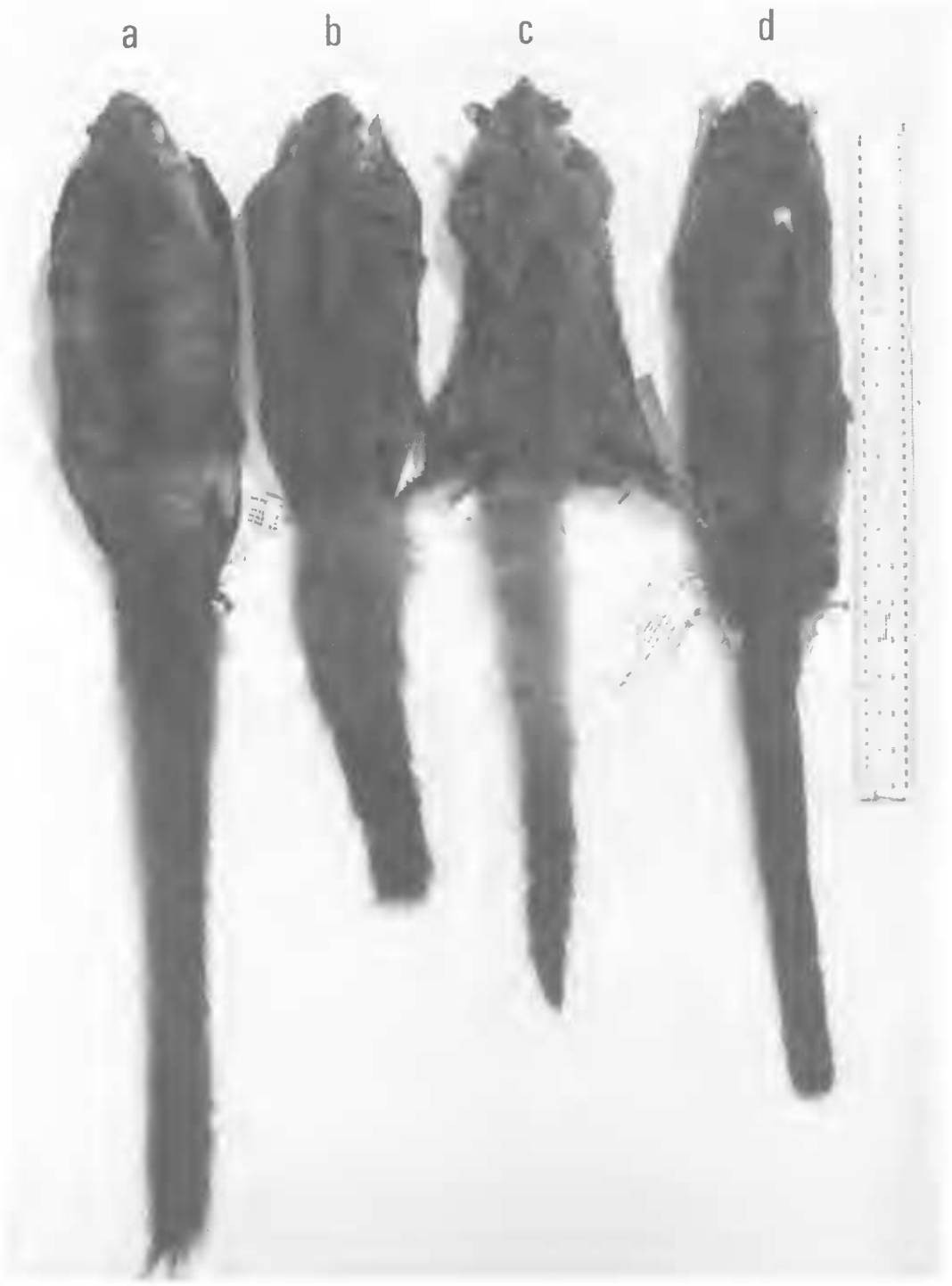

FIG. 2. Comparison of skin size in the Mt Echo *Petaurus norfolcensis* (c) JM5521 (Queensland Museum) with: (a) *P. australis,* CM 207 (CSIRO, Wildlife Canberra) from Bonalbo N. N.S.W. (b) *P. norfolcensis,* CM 25 (CSIRO, Wildlife Canberra) from Albury N.S.W. (largest *P. norfolcensis* skin available). (d) *P. abidi* (paratype) PNGMR 23215 (National Museum and Art Gallery, Papua New Guinea, Boroko) from Mt Somoro, Papua New Guinea.

Cardwell' would have put Broadbent to the northeast and other side of the Cardwell Range. It is possible that de Vis' presented locality data were inaccurate.

This suggestion also assumes that de Vis did not label a holotype as such, and that the 1886 date shown on the labels and accession card is either incorrect as a collection date, or is an accession date.

No other reference can be found to the cabinet name on specimen tags and accession cards. If the three specimens represent the original 1882 Broadbent specimens, the cabinet name may have been an early de Vis choice later to be discarded in favour of *gracilis*.

(b) The gliders represent the form *gracilis*, but were collected four years later by Broadbent at or close to the type locality (near Cardwell). This possibility raises the puzzling question of why they should be labelled with the cabinet name after the published description of the virtually identical *gracilis*.

(c) The gliders represent a form collected in 1886 by Broadbent, which de Vis considered distinct enough to warrant a cabinet name, but which was never described by him. In this case the similarity of the three study skins to the formal description of *gracilis* is coincidental.

Unfortunately, de Vis freely interchanged references to the collection locality, 'Herbert River' with 'Herberton' (17°23'S, 145°23'E) a town 145 km NW of Mt Echo and formally gazetted in 1880. His indexing card for the three gliders notes their collection locality as 'Mt Echo, Herberton'. His description of 'New and rare vertebrates from the Herbert River North Queensland' (de Vis 1886) frequently makes reference to the 'Herberton Petaurist' or the 'Herberton Mountains' (p. 1134) for the area of the Main Range, north of the Herbert River.

The collection area for the three Broadbent gliders, Mt Echo (18°54'S 145°48'E) is now part of Yamanie National Park and is situated approximately 50 km NW of Ingham, northeast Queensland. A short but unsuccessful attempt was made by me in June 1986 to locate living representatives of the old glider skins on Mt Echo and adjacent areas. The vegetation types in the area varied through floodplains of the Herbert River to the vine forest summit of Mt Echo (c.700 m above sea-level). On the floodplains, open and tall woodland species consisted of *Eucalyptus tereticornis, E. pellita, E. intermedia* and *Melaleuca dealbata*, with small patches of mesophyll vine forest and open forest and woodland species such as *Melaleuca quinquenervia, M. viridiflora* and *E. alba*. This changed on the steep foothills to medium-low woodland dominated by *E. alba, E. intermedia* and *Tristania suaveolans* 15-18 metres in height. A dense ground layer of *Imperata cylindrica, Heteropogon contortus* and *Themeda australis* made climbing the mountain difficult. The moist uplands and sheltered gullies were characterized by vine forest of which the major species were *E. intermedia, Syncarpia glomulifera, T. conferta, Casuarina torulosa* and *Banksia compar*, 20-30 metres in height. These vegetation types correspond roughly with types 2a, 16g, 16p, 13f and 19 of Tracey (1982).

The vegetation of Mt Echo has probably altered little since Broadbent's day. In his diary entry for Saturday, July 3 1886, he describes the Mt Echo terrain in the following manner: 'I have 15 miles to go to get Yabbies from here, on top of the main range and travelling is a terror in this country, the grass in the open places in the mountains is 6 feel high broad blady grass cuts like a knife, all the mountain creeks are nearly a swim and then to climb those mountains is a caution rocks and precipices thrown together in beautiful confusion and covered with dense jungle, great masses of lawyer palms tear flesh and clothes to pieces'.

It is possible, therefore, that the glider still exists somewhere on the rugged slopes of Mt Echo or in its vicinity.

A REASSESSMENT OF THE MT ECHO MATERIAL

Unlike many other Australian mammals, large body size in *Petaurus norfolcensis* is not restricted to specimens from the southern limits of the species' range, and in that respect does not conform with Bergmann's rule (see Yom-Tov and Nix, 1986). Large specimens, approaching the size of the Mt Echo gliders, have been recorded from Albury, NSW (36°05'S, 146°51'E, e.g. CM 25), Fraser Island, SE Qld (25°33'S, 152°59'E, e.g. J11237) and Cape River, NE Qld (20°50'S, 146°15'E, e.g. JM5058). Russell (1980) comments on a large female from Watsonville, NE Qld (17°23'S, 145°19'E). None of these larger than average specimens, however, displayed the slender, sparsely-haired tails of the Mt Echo skins, the caudal morphology of which most closely resembles *Petaurus abidi* from Papua New Guinea rainforest.

TABLE 1. Measurements for *Petaurus norfolcensis* from Queensland compared with large specimens JM5521-3 (Queensland Museum) from Mt Echo; CM 25 (CSIRO Canberra) from Albury, N.S.W.; JM5058 (Queensland Museum) from Cape River, Qld; BM 41.1227 (British Museum, Natural History) from Liverpool Plains, N.S.W. and *P. abidi* BBM-NG 101818 (Bishop Museum, Hawaii) from Papua New Guinea. The method of mensuration is demonstrated in Fig. 1.

	Petaurus norfolcensis Queensland						JM 5521	JM 5522	JM 5523	CM 25	JM 5058	BM 41.1227	BBM-NG 101818
	Measurement (mm)	N	$\bar{x} \pm R$	OR	SD	CV							
1	M^{1-4} (crown)	41	8.03 ± 0.06	7.14 – 8.93	0.36	4.48	9.10	8.55	8.84	—	8.42	8.37	9.70
2	P^3-M^4 (crown)	41	9.82 ± 0.06	9.02 – 10.80	0.41	4.17	11.23	10.68	10.77	—	10.60	10.40	11.73
3	I^1-P^1	40	8.37 ± 0.11	7.42 – 9.30	0.67	8.00	9.85	9.16	9.78	8.90	8.69	8.71	9.28
4	I^1-P^4	40	14.37 ± 0.13	12.40 – 16.30	0.81	5.64	16.71	16.12	16.53	15.92	15.51	16.03	17.40
5	I^1-M^4	40	21.63 ± 0.14	20.21 – 23.60	0.86	3.98	24.71	23.97	24.54	—	23.22	23.68	25.56
6	nasal width	38	4.32 ± 0.11	3.24 – 6.21	0.67	15.51	6.69	5.54	5.29	4.81	3.82	4.28	5.57
7	rostral height	38	12.48 ± 0.12	10.79 – 13.73	0.75	6.01	12.96	13.85	13.41	13.63	11.25	—	14.25
8	lachrymal width	38	13.49 ± 0.11	12.10 – 15.20	0.69	5.11	15.05	16.95	15.32	15.29	12.82	14.97	15.15
9	ramal width	41	11.07 ± 0.10	10.01 – 12.32	0.67	6.05	13.28	13.61	13.07	11.73	12.08	11.46	12.80
10	zygomatic width	38	30.03 ± 0.19	27.93 – 32.40	1.16	3.86	—	—	34.19	32.00	30.79	—	34.61
11	interorbital width	40	9.01 ± 0.09	7.26 – 9.84	0.56	6.22	8.73	10.73	7.62	9.21	9.04	8.07	10.06
12	I_1-M_4	41	13.02 ± 0.09	11.74 – 14.22	0.61	4.69	14.93	14.37	14.49	—	13.88	14.24	—
13	M_{1-4} (crown)	41	8.67 ± 0.05	7.99 – 9.24	0.32	3.69	9.79	9.25	9.15	—	9.12	9.27	—
14	M_1 width	41	1.80 ± 0.01	1.67 – 1.99	0.08	4.44	2.03	2.07	1.95	—	1.87	2.04	—

Fortunately the collector, Broadbent, had left one complete skull inside one skin, JM5523, and partial skulls inside the skins of JM5521 and JM5522. These skulls have never before been examined. They have been extracted and their dental and cranial morphology compared against other known gliders. The tooth row is massive and the skull is larger than in any known specimen of *P. norfolcensis*, or as de Vis put it 'intermediate between *B. australis [Petaurus australis]* and *B. sciureus [P. norfolcensis]*' (de Vis 1883c, p. 620) (Table 1, Fig. 3, Fig. 1).

While the Mt Echo specimens approach *P. abidi* in skull and tooth size, their dental and cranial affinities lie not with *P. abidi* (whose affinities are with *P. australis*) but with *P. norfolcensis*.

At this stage there seems little justification in advocating full specific status for the three Mt Echo gliders JM5521-3 despite their consistently large size and long, slender tails. In addition it would seem inappropriate to continue the use of the subspecific reference *P. norfolcensis gracilis* in respect of all northeastern and mideastern Queensland examples of *P. norfolcensis*, which are indistinguishable from their more southern conspecifics.

DISCUSSION

The publication of Oldfield Thomas' 'Catalogue of the Marsupialia' (1888) must have done little to boost de Vis' self-confidence as a mammalian taxonomist. In the catalogue, Thomas synonymised all the extant mammals which de Vis had described up to its publication in 1888 (*Belideus gracilis, Halmaturus jardinii, H. gazella, H. temporalis, Onychogalea annulicauda*).

It is difficult to explain de Vis' poor record in extant marsupial taxonomy. It is insufficient to suggest that he lacked the necessary literature with which to test his thoughts. De Vis had been the librarian at the Rockhampton School of Arts immediately prior to assuming his curatorial position in the Queensland Museum. While he may not have had all the relevant literature available to him then, he would have been familiar with those

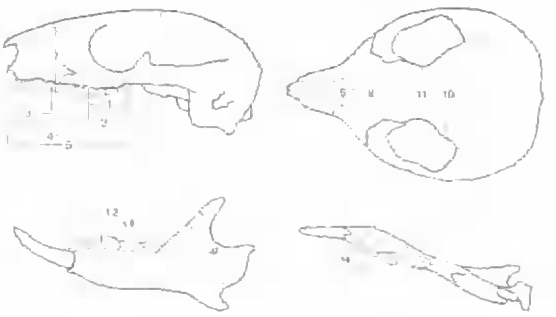

FIG. 3. Method of mensuration used in association with all *Petaurus* skulls measured. Numbers correspond with numerical sequence of measurements in Table 1.

procedures associated with literature searches and the acquisition of relevant mammalian works. When he took office in the Queensland Museum in 1882 the library was already well stocked and growing (Wixted, 1986) and Gould's 'Mammals of Australia' had been purchased by W.A. Haswell from Williams and Norgate, Covent Garden, London in 1880. In the light of Gould's substantial treatment of the Feathertail glider *Acrobates pygmaeus,* it is hard to excuse de Vis' unwarranted description of *Dromicia frontalis.*

De Vis may have been facing serious competition from southern and overseas institutions, which were employing collectors during the late 1800's to provide them with material from north Queensland, many of which were previously unknown to science. A note of professional rivalry with Collett can be detected in de Vis' rash description of *Pseudocheirus mongan* (*P. herbertensis*). 'There is reason to fear that the describer of *Phalangista (Pseudochirus) Herbertensis* has been led into a mistake in his determination of the sexes of that *Phalanger*. It would appear that in the mountain-top scrubs of the Herbert Gorge there are two associated species of *Pseudochirus,* and that these are, curiously enough, not distinguished from each other by the natives of the locality, who give to them the common name 'Mongan'. From such community of name has probably resulted an idea that they are identical, and this, communicated to Mr Collett, has no doubt misguided him in his determination' (de Vis, 1886, p. 1130).

Collett's (1884) creditable description was based on material collected by Lumholtz from the Herbert River district at almost the same time as Broadbent was collecting there. De Vis' description of *P. mongan* might be interpreted as a dyspeptic attempt to save face in the light of four new marsupial species (*P. archeri, Hemibelideus lemuroides, P. herbertensis* and *Dendrolagus lumholtzi*) being described from under his nose. De Vis' failure to appreciate the natural range of colour variation found in *P. herbertensis* (Van Dyck, 1980), which led to his description of *P. mongan,* demonstrates one of the inherent dangers of being a 'closet naturalist' (Ingram, 1986, p. 157).

It could also be argued that there were probably high expectations of new mammals, as well as new species of birds, in the barrage of material being forwarded by Broadbent from north Queensland. Moreover, the case before the Museum's Board for Broadbent's future employment as a collector could be strengthened if more new species were described as a direct result of his efforts.

The multiple problems associated with matching the de Vis description of *B. gracilis* with the three Mt Echo specimens may never be resolved. However, it is still possible that living specimens may be rediscovered on or near the mountain. Until then, in the words of de Vis (1907) '. . . I feel hardly justified in running the risk of perpetuating a synonym . . .' and defer to the judgement of Thomas (1888) who treated *gracilis* simply as a junior synonym of *Petaurus nofolcensis.*

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NOTE ADDED IN PROOF: At 12:32AM, 6 Dec. 1989, living representatives of *B. gracilis* were located at Barrett's Lagoon, 18°02'S, 146°58'E, 14 km SE of Tully. To pay one's devoirs to de Vis, Barrett's Lagoon is 24 km N of Cardwell, precisely the vicinity referred to in his original description.